HOMESTAKE
Grants Project

Homestake Mining Company of California

Thomas Wohlford
Closure Manager

27 January 2018

Document Control Desk
U.S. Nuclear Regulatory Commission,
Washington, DC 20555–0001

Mr. Jeffrey Whited
Materials Decommissioning Branch (Mail Stop T-8F5)
Decommissioning, Uranium Recovery, & Waste Programs
Office of Nuclear Material Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555–0001

Mr. William Pearson
Ground Water Quality Bureau
New Mexico Environment Department
PO Box 5469
Santa Fe, NM 87502-5469

ATTN: Mr. Sairam Appaji
Region VI Superfund Division
1445 Ross Avenue, Suite 1200
6SF-LP
Dallas, TX 75202-2733

ATTN: Mr. Christopher Burrus
New Mexico Office of the State
Engineer 5550 San Antonio Drive,
N.E. Albuquerque, NM 87109

RE: Homestake - Grants - San Andres Well 943M Drilling and Installation

Dear Sirs:

Homestake Mining Company (HMC) has completed the installation of San Andres aquifer monitoring well 943M. The well was installed near San Andres-Glorieta (SAG) water supply well 943 and the attached report describes the drilling and completion of monitor well 943M, as well as the testing and initial sampling of the newly installed well. Well 943M is currently included as an observation well in the testing of water supply well 943, and additional water quality and water level data will be included in the reporting of the well 943 testing.

Thank you for your time and attention on this matter. If you have any questions, please contact me at the Grants office at 505.287.4456, extension 34, or call me directly on my cell phone at 505.290.2187.

90041809

Respectfully,

Thomas Wohlford
Closure Manager
Homestake Mining Company of California
Office: 505.287.4456 x34 | Cell: 505.290.2187

Copy To:

B. Tsosie, DOE, Grand Junction, Colorado (electronic copy)
C. Burton, Barrick, Henderson, Nevada (electronic copy)
R. Whicker, ERG, Albuquerque, New Mexico (electronic copy)
G. Hoffman, Hydro-Engineering, Casper, Wyoming (electronic copy)

HOMESTAKE MINING COMPANY OF CALIFORNIA

Grants Reclamation Project

San Andres Well 943M Completion Report

January 2018

George L. Hoffman, P.E. Adam Arguello Thomas G. Michel, Ph.D.

Table of Contents

List of Tables

List of Figures

List of Acronyms and Abbreviations

ft	feet or foot
gal	gallon
gpm	gallon(s) per minute
GRP	Grants Reclamation Project
KPA	Kinetic Phosphorescence Analyzer
lbs	pounds
HMC	Homestake Mining Company
mg/l	milligram per liter

1. INTRODUCTION

The following report describes the installation of San Andres monitoring well 943M at the Homestake Mining Company of California (HMC) Grants Reclamation Project (GRP). Well 943M is a San Andres–Glorieta (SAG) aquifer well installed for the purpose of monitoring SAG aquifer water levels and quality and as an observation well for a planned test using nearby SAG well 943 as the pumping well. The Office of the State Engineer POD number for well 943M is B-28-POD-1384.

Well 943M is located approximately 200 feet west-northwest of well 943 and the lithology for well 943 was used in planning of the installation of well 943M. Well 943 is completed in the San Andres limestone and the underlying Glorieta sandstone to a depth of 978 feet. A general increasing trend in the uranium concentration in well 943 indicates a likely connection with impacted overlying aquifer(s) within the Chinle Shale, and this prompted the installation of well 943M.

The drilling of well 943M started on 12/16/17 with a surface casing and the artesian casing was installed on 12/22/17. The drilling and setting of the well screen within the San Andres occurred on 12/27/17 and the well was developed by airlifting on 12/28/17. A pump was installed in the well early in January of 2018, and the well was pumped to obtain a sample for testing by Kinetic Phosphorescence Analyzer (KPA) on 1/8/18. The well was pumped for approximately two hours on 1/12/18 to obtain a sample for laboratory analysis of site standard constituents plus U-234, U-235, U-238, PO_4, F and other major constituents.

2. WELL 943M DRILLING

Well 943M was installed as an artesian SAG well beginning on 12/16/17. The total depth of the well is 800 feet with 70 feet of well screen installed to extend 60 feet into the San Andres limestone. The drill time log for well 943M is presented in Figure 2-1 and the corresponding lithologic log is presented in Figure 2-2. The well completion schematic is presented in Figure 2-3. Geophysical logging was performed during the drilling and the neutron and gamma logs are presented in Figure 2-4 with the resistivity and gamma logs presented in Figure 2-5.

2.1 Drilling

Figure 2-1 presents the drill time log for well 943M with drilling to install the surface casing beginning on 12/16/17. The surface casing consisted of 80 feet of 12.75 inch outside diameter (OD) steel casing cemented to the surface in a 15 inch diameter hole (see Figure 2-3). The drilling for the artesian began early in the morning on 12/18/17 (see Figure 2-1) and was advanced to a depth of 740 feet on 12/20/17. Geophysical logging was performed on 12/20/17 in the open hole below the bottom of the surface casing, and again after the artesian casing was installed, and the results are discussed in Section 2.3. Following the initial geophysical logging, the hole was reamed to a diameter of 10.625 inches from the base of the surface casing to a depth of 740 feet. A loss of circulation on 12/18/17 at a depth of approximately 180 feet required use of additional mud and lost circulation material to regain circulation. After the installation and cementing of the artesian casing (6.625 inch OD), the drilling was extended to a depth of 800 feet with a 5.5 inch diameter hole. A 70 feet long section of four (4) inch diameter wire-wrapped stainless steel well screen was then placed to extend 60 feet beyond the base of the artesian casing, which is at a depth of 740 feet. This resulted in the well screen extending approximately 10 feet above the base of the artesian casing. A geophysical log was then performed to a depth of approximately 730 feet.

2.2 Well Casing

Figure 2-3 presents the completion diagram for well 943M. Three casing sections consisting of the surface casing (12.75 inch OD steel), artesian casing (6.625 inch OD steel) and well screen (4 inch diameter stainless steel) were installed in the well. The surface casing extended 80 feet below land surface and penetrated the alluvium and an estimated 30 to 36 feet into the Chinle Shale. The surface casing was grouted with neat cement with a density of 15.4 lbs/gallon.

The artesian well casing was placed from the surface to a depth of 740 feet and grouted with neat cement (15.3 lbs/gallon) by the Halliburton method on 12/22/17. The well was pressure tested to 350 psi on 12/26/17 (see Figure 2-2). After the pressure testing, drilling for installation of the well screen resumed.

The four (4) inch diameter wire-wrapped stainless steel well screen was placed from a depth of 730 feet to 800 and extended approximately 60 feet beyond the base of the artesian casing. The well

screen extended into the boring in the San Andres limestone with an indicated top of the limestone occurring at a depth of approximately 710 feet (see Figure 2-2).

2.3 Logging and Lithology

The lithology of well 943M was described from cuttings during the drilling and was also evaluated using geophysical logs. The recorded lithologic log is presented in Figure 2-2 and the neutron, gamma, and caliper logs are presented in Figure 2-4. The gamma, caliper and a suite of resistivity logs are presented in Figure 2-5.

2.3.1 Lithologic Log

The lithologic log presented in Figure 2-2 indicates the base of the alluvium occurs at a depth of approximately 50 feet and is underlain by the Chinle shale. The geophysical logs discussed in the following subsections provide a slightly more refined interpretation of the base of alluvium at a depth of approximately 44 feet.

The occurrence of sandstone or other coarser material in the lithologic log corresponding to the Middle Chinle aquifer is within the interval from 210 to 270 feet below land surface. However, the geophysical logs described below and the loss of circulation at a depth of approximately 180 feet indicates more permeable material is present above a depth of 210 feet. Therefore, the geophysical logs offer a more refined interpretation of the location of the Middle Chinle aquifer. Like the Middle Chinle aquifer, the lithologic log notes the presence of coarser material corresponding to the expected interval for the Lower Chinle aquifer but the noted intervals only allow a crude identification of the aquifer interval.

The first indication of limestone in the lithologic log occurs in the interval from 690 to 710 feet below land surface. Below a depth of 710 feet, the lithologic log indicates the San Andres limestone is present to the bottom of the boring at 800 feet below land surface. Although there were no cuttings returned below a depth of 780 feet, there is little doubt that the drilling was still within the San Andres Limestone. Based upon the lithologic log, the top of the San Andres limestone is interpreted as being at a depth of approximately 710 feet, with a transition from Chinle Shale occurring from 690 to 710 feet below land surface.

2.3.2 Geophysical Logging

Figure 2-5 presents the neutron, gamma ray and caliper logging for well 943M. The geophysical logging conducted for the open hole and for the well with artesian casing and well screen installed is combined in Figure 2-5. The logging run in the open hole encountered an obstruction at a depth of approximately 455 feet and only the upper 455 feet was logged. The combination of two logging runs results in two caliper logs with one in the open hole and a log run within the artesian casing. The open hole caliper log indicates a transition from the surface casing diameter to the smaller drilling diameter at a depth 68 to 74 feet. However, the surface casing extends to a depth of

approximately 80 feet so the transition in diameter likely indicates that cuttings accumulated inside the surface casing for several feet above the base of the surface casing prior to the logging.

The gamma ray log within the open hole (below the surface casing) and within the artesian casing gives a reasonable indication of the base of the alluvium with a noticeable increase at a depth of approximately 44 feet. The three neutron logs in Figure 2-4 are useful in interpreting the interval of the Middle Chinle aquifer with a significant increase in neutron counts typically indicating more permeable material. There are three significant intervals between a depth of approximately 156 feet and 256 feet with a total thickness of 40 to 45 feet that are considered the Middle Chinle aquifer (see Figure 2-4). The resistivity logs presented in Figure 2-5 also show three significant intervals between a depth of approximately 156 feet and 256 feet that correspond with the more permeable intervals indicated in the neutron logs.

The neutron logs also indicate two intervals at approximately 380 to 395 feet below land surface and 446 to 480 feet below land surface that represent the Lower Chinle aquifer. The upper interval of the Lower Chinle aquifer is also reflected in the resistivity logs in Figure 2-5. From a depth of 480 feet to approximately 690 feet the gamma ray and neutron logs indicate Chinle Shale, and this is consistent with the lithologic log.

The gamma ray and neutron logs in Figure 2-5 do not show an abrupt change indicating the presence of the San Andres limestone. There is a minor reduction in gamma counts at a depth of 694 feet and a gradual increase in neutron counts below a depth of approximately 675 feet. However, the lithologic log is considered a more reliable indicator of the top of the San Andres limestone.

HYDRO-ENGINEERING, LLC

Drill Time Log

Well Name:		943M	Start Date:		12/16/2017
Driller:		Stewart Brothers	Eng/Geog:		Adam Arguello
		Drill Time Log			Pump Installation and Testing
12/16/17	10:30	Surface casing driling started	1/8/18		Pump installed during prior week
	11:00	Total depth for surface casing reached		14:45	Pump operated briefly to collect sample for KPA analysis
12/17/17	1:30	Surface casing set	1/12/18	7:00	Pump test conducted and sample collected
	4:00	First batch of cement poured, 1.1 cubic yards, 15.4 lbs/gal			
	5:10	Second batch of cement poured, 1.1 cubic yards, 15.4 lbs/gal			
12/18/17	4:50	Artesian Casing driling started			
	9:00	Circulation lost			
	16:00	Circulation regained			
12/20/17	13:00	Total depth for artesian casing reached			
	22:00	Logger hung up in hole at 420'			
	23:00	Started reaming hole for artesian casing			
12/21/17	12:00	Finished reaming hole for artesian casing			
12/22/17	4:00	Artesian casing set			
	10:00	2 cement trucks placed via Halliburton method (7 cubic yards each), 15.3 lbs/gal			
12/26/17	12:00	OSE inspected pressure test, 350 psi			
12/27/17	11:00	Circulation lost			
	13:00	Total depth for screen reached			
	19:00	Screen placed			
12/28/17	8:00	Airlifting for development started			
	9:45	End of airlifting			

Figure 2-1. Well 943M Drill Time Log

HYDRO-ENGINEERING, LLC

Lithologic Log

Well Name:	943M	Start Date:	12/16/2017
Driller:	Stewart Brothers	Eng/Geog:	Adam Arguello
0'-10'	brown clay with sand		
10'-50'	tan sand, small gravel and clay		
50'-150'	purple and red shale		
150'-210'	purple shale		
210'-250'	purple sandstone		
250'-270	white and gray sandstone		
270'-360'	red shale with gray and white flecks		
360'-400'	red shale with gravel and sandstone		
400'-480'	purple shale		
480'-550'	red shale		
550'-580'	purple and red shale fractured		
580'-600'	purple shale with white sandstone and gravel		
600'-690'	gray shale with streaks of purple		
690'-710'	purple shale and white limestone		
710'-780'	white limestone		
780'-800'	No returns		

Figure 2-2. Well 943M Lithologic Log

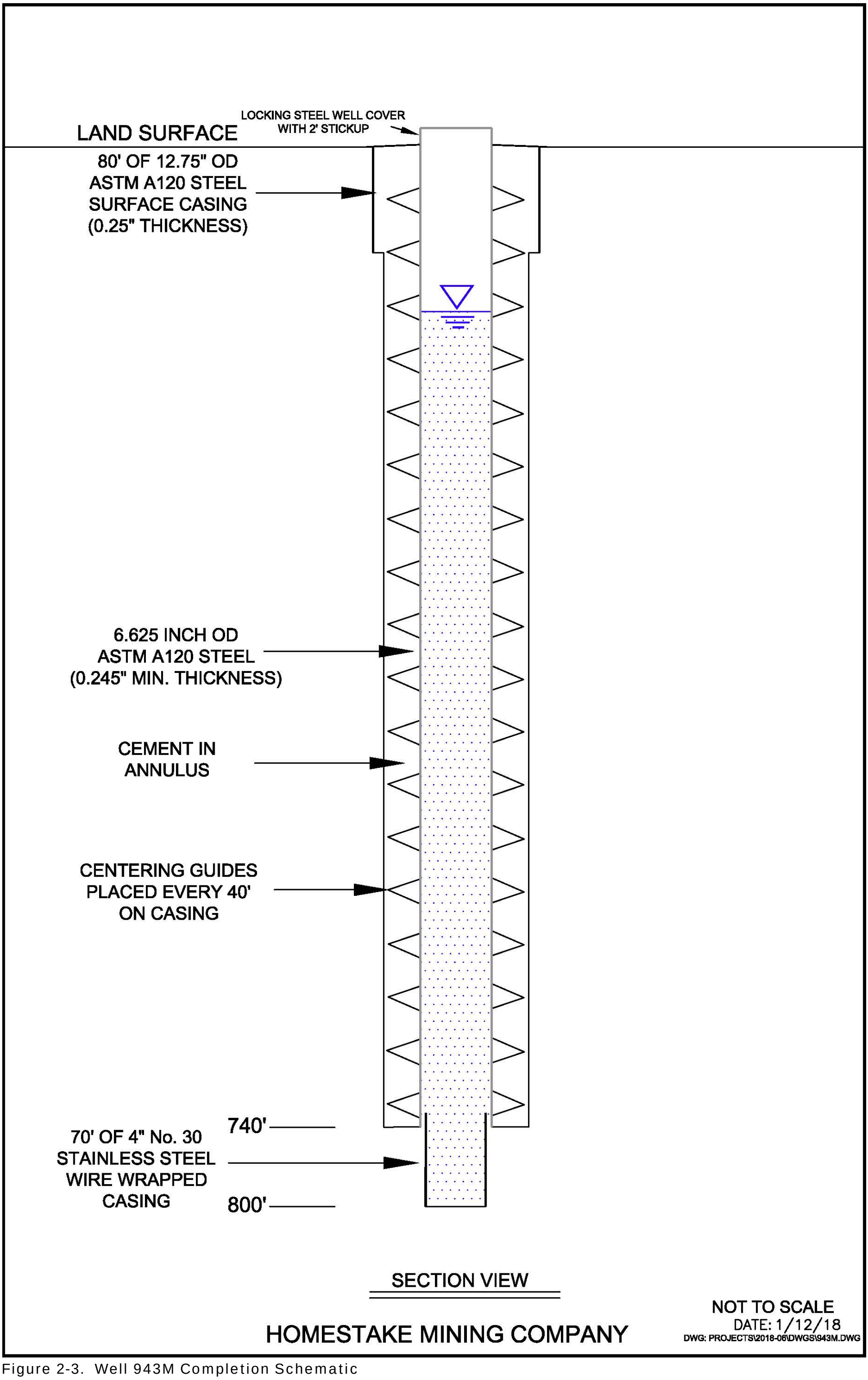


Figure 2-3. Well 943M Completion Schematic

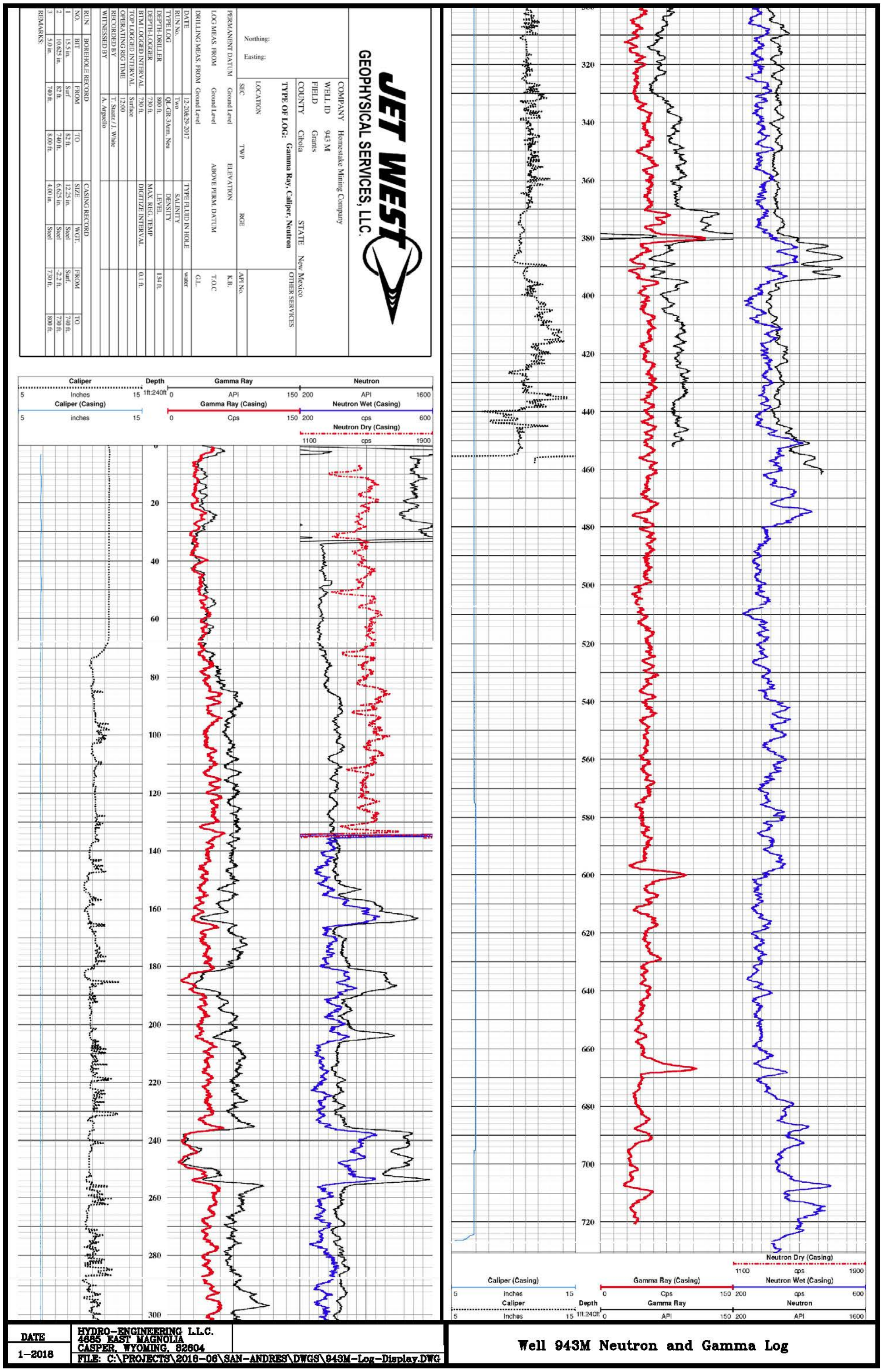


Figure 2-4. Well 943M Neutron and Gamma Log

JET WEST
GEOPHYSICAL SERVICES, LLC.

COMPANY Homestake Mining Company
WELL ID 943 M
FIELD Grants
COUNTY Cibola STATE New Mexico

TYPE OF LOG: Electrics, Gamma Ray, Caliper

OTHER SERVICES
Neutron
Cased Hole Neutron
Cased Hole Gamma Ray

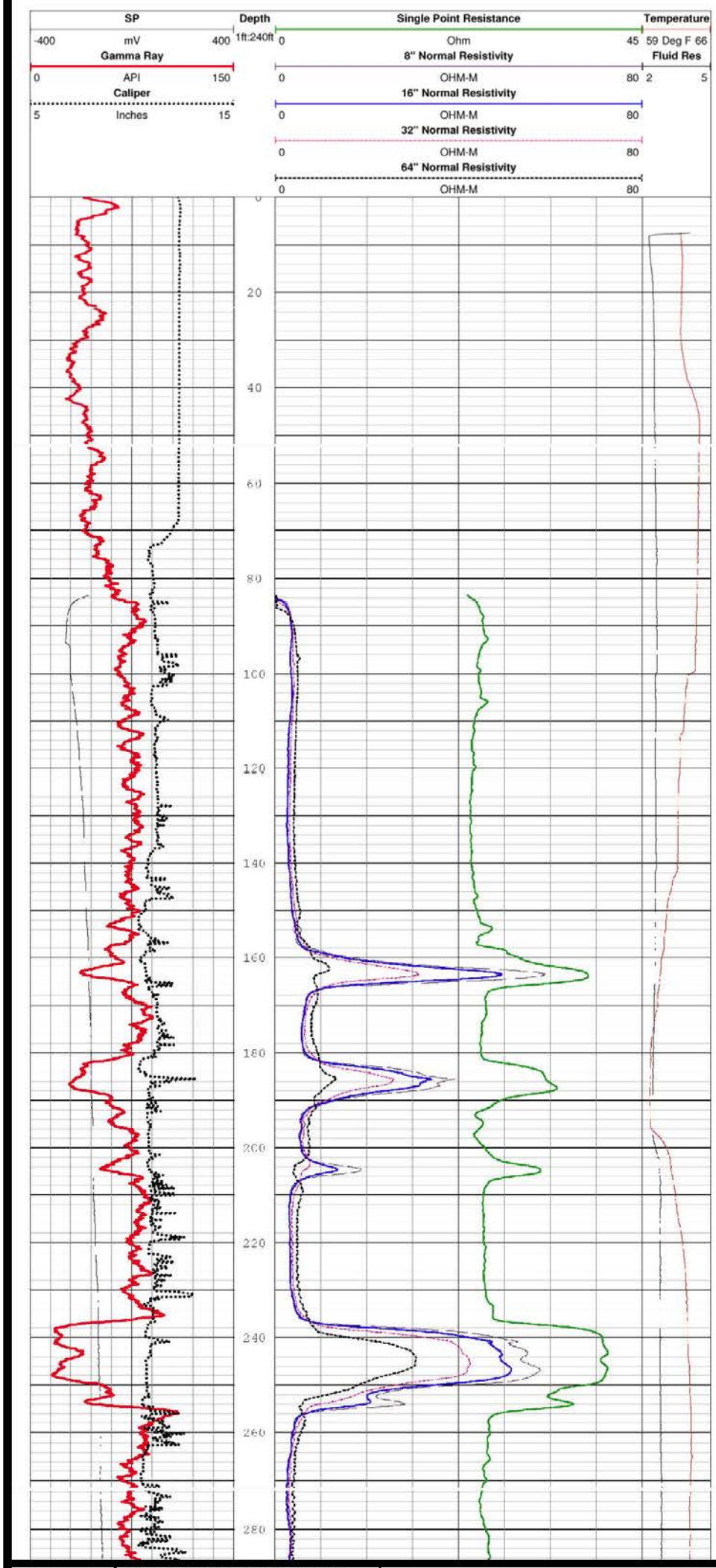
Northing:
Easting:

LOCATION				API No.
SEC	TWP	RGE		

PERMANENT DATUM	Ground Level	ELEVATION	K.B.
LOG MEAS. FROM	Ground Level	ABOVE PERM. DATUM	T.O.C
DRILLING MEAS. FROM	Ground Level		G.L.
DATE	12-20-2017	TYPE FLUID IN HOLE	water
RUN No.	Two	SALINITY	
TYPE LOG	QL-GR-3Arm. Neu	DENSITY	
DEPTH-DRILLER	740 ft.	LEVEL	Surface / 20 feet
DEPTH-LOGGER	460 ft.	MAX. REC. TEMP	
BTM LOGGED INTERVAL	459 ft.	DIGITIZE INTERVAL	0.1 & 0.5 ft.
TOP LOGGED INTERVAL	Surface		
OPERATING RIG TIME			
RECORDED BY	T. Staatz / J. White		
WITNESSED BY	Stewart Brothers		

RUN NO.	BOREHOLE RECORD BIT	FROM	TO	CASING RECORD SIZE	WGT.	FROM	TO
1	15.5 in.	Surf	82 ft.	12.25 in.	Steel	Surf.	740 ft.
2	10.625 in.	82 ft.	740 ft.				
3							

REMARKS:



DATE	
1-2018	HYDRO-ENGINEERING L.L.C. 4685 EAST MAGNOLIA CASPER, WYOMING, 82604 FILE: C:\PROJECTS\2018-06\SAN-ANDRES\DWGS\943M-Log-Display.DWG

Well 943M Resistivity and Gamma Log

Figure 2-5. Well 943M Resistivity and Gamma Log

3. WELL TESTING

After installation of a pump for sampling of the well in early January of 2018, a brief test of the well was conducted to collect a sample for KPA analysis of uranium concentration, and this was followed by two hour pump test to evaluate well and aquifer properties and to collect a sample for laboratory analysis. The preliminary test of the well was conducted on 1/8/18 and the well was pumped for approximately 20 minutes to collect a sample for KPA analysis. The resulting uranium concentration from the KPA analysis was below the effective minimum reporting level for the instrument. The typical minimum reporting level for uranium concentration with the KPA instrument is estimated at 0.005 mg/l, but this level is subject to change with chemical interference or other properties of the sample. However, the preliminary KPA sample confirmed that uranium concentration in well 943M is below levels of concern for discharge during the pump test.

3.1 Well Testing

An aquifer properties and well sampling test was conducted by pumping well 943M for approximately two hours on 1/12/18. The data from the field sampling report sheet (see Figure 3-1) are summarized in Table 3-1. Field water quality parameters of temperature, conductivity, pH and ORP were recorded during the test at 20 minute intervals. Field water quality measurements were relatively stable for the last 40 to 60 minutes of the test (see Table 3-1). A sample was collected for laboratory analysis of HMC's site standard constituents plus U-234, U-235, U-238, PO_4, F, and other major constituents. The sample is in process and the results will be reported when they are available.

Table 3-1. Well 943M Testing and Sampling

Well 943M Sampling - 1/12/2018

Pump Start:	7:00
Pump Stop:	9:00
Pump Rate:	25 gpm
Lab Sample	
Collected:	9:00

	Water Quality Measurements			
Time	Temperature (deg. C)	Conductivity (uS)	pH (S. U.)	ORP (mV)
7:01	11.5	1788	7.64	
7:04				115
7:20	12	1741	7.38	133
7:40	15.4	1723	7.13	130
8:00	14.4	1897	7.00	94
8:20	14.1	1901	7.12	70
8:40	14.9	1911	7.14	67
9:00	14.5	1924	7.13	64

3.2 Aquifer Properties

As part of the ongoing well 943 testing program, a logger/transducer was installed in wells 943M, 943 and other wells on 1/5/2018. The water level data from the transducer in wells 943M and 943

were downloaded and used to evaluate water level changes during the test on 1/12/18. Figure 3-2 presents the water level changes occurring in wells 943M and 943 prior to, during, and after the pump test during the morning of 1/12/18. There is a small discrepancy of one to two minutes in the start and stop times for pumping when comparing the transducer data with the times recorded by the technician during the sampling. The internal clock for the logger/transducer is set by the clock in the computer used to program the loggers during installation, while the technician likely records times based on a watch so the discrepancy is not significant and is easily explainable.

Figure 3-2 illustrates the water level changes in wells 943M and 943 recorded by the transducer at one minute intervals during the morning of 1/12/18. The water level in both wells was relatively stable for the hour preceding the test. The first significant drawdown occurred in well 943M at 7:02 so the pump start likely occurred around 7:01 according to the logger/transducer clock. The changes in water level were somewhat erratic through the first thirty minutes of the test, but generally exhibited an average drawdown of 0.1 to 0.2 feet. After the first hour of pumping, the water-level change stabilized at an average drawdown of 0.162 feet. Using this drawdown and the reported discharge rate of 25 gpm, the calculated specific capacity of the well is approximately 154 gpm/foot.

The transducer data indicates an abrupt rise in the water level in well 943M at 9:58 and this is consistent with a pump shut-off that results in the water in the pump column draining back into the well. This change if followed by a quick oscillation and the start of recovery in the well. The water-level recovers to the pre-test level within approximately 30 minutes of the stop of pumping, and continues to increase indicating that a rising trend in the San Andres aquifer was occurring and had likely started during the test. The occurrence of changes in the San Andres water levels is expected because numerous users operate production wells completed in the San Andres aquifer, and there are frequent changes in the transducer data associated with these aquifer stresses.

The water level in well 943 also responded to the pumping of well 943M with an effective drawdown of approximately 0.03 feet occurring during the pumping. The recovery in well 943 also began shortly after pumping stopped, and like well 943M, the water level recovery indicated that a rising water-level trend was occurring in the San Andres aquifer.

The recovery occurring in well 943M allows an estimation of aquifer transmissivity using the Theis recovery analysis. Because well 943M was constructed as a monitoring well, the installed pump is sized to allow efficient sampling and is too small to effectively stress an aquifer as transmissive as the San Andres limestone. Hence, the magnitude of the drawdown in well 943M is very small, and the aquifer test analysis methods can only provide a rough estimate of transmissivity. Figure 3-3 presents a semilog analysis of well 943M recovery data using the Theis method. The data selected for the linear fit are those occurring shortly after the pump was shut off through the point when the recovery exhibits the influence of the water-level change trends from well operation by other San Andres aquifer users. The estimated transmissivity from this analysis is 85,000 gal/day/foot which

is a reasonable value for the San Andres aquifer. As previously mentioned, the magnitude of the drawdown is small and the resolution of the transmissivity estimate is limited by the relatively small stress rate.

HOMESTAKE MINING COMPANY

EDF - 21 - ANALYTICAL SHEET

Well Name	Collection Date	Collected By:	Water Level	Pumping Rate (gpm) Code: 0058	
943 M	1 / 12 / 18 MM/ DD/ YY	Jason Dominguez	Code: 0013	Measured	File
				25 Gpm	
Well I.D.	Time: 09:00 HR:MIN	Title: Rad/Teck Utillity Operator	PH 7.13	Bail Volume (gal) Code: 0017	
				Measured	File

Pumping or Bailing Duration (min) Code: 0059	Q (totalizer reading) Code: 0054	Conductivity	Code: 0012	Code: 0051	
Start: 07.00	MO Meter	Time: 0701	Temp: 11.5c	Cond: 1788us	PH 7.64
Stop: 0900		Time: 07:20	Temp: 12.0c	Cond: 1741us	PH 7.38
Remark K		Time: 07:40	Temp: 15.4c	Cond: 1723us	PH 7.13

Previous Water Level:	Total Depth (FILE):	Analysis Requested:
	Total Depth (MEASURED):	B, F

Comments:

	Tem	Cond.	PH
08:00	14.4c	1897us	7.00
08:20	14.1c	1901us	7.12
0840	14.9c	1921us	7.14
9:00	14.5c	1924us	7.13

7:04 ORP - 115
7:20 - ORP - 133
7.40 ORP - 130
8:00 ORP - 94
820 ORP - 70
840 - ORP - 67
900 - ORP - 64

Name:	Pump Size:
Address:	Casing Diameter: 8.
	Usage:
Telephone Number:	

Figure 3-1. Well 943M Field Sampling Form

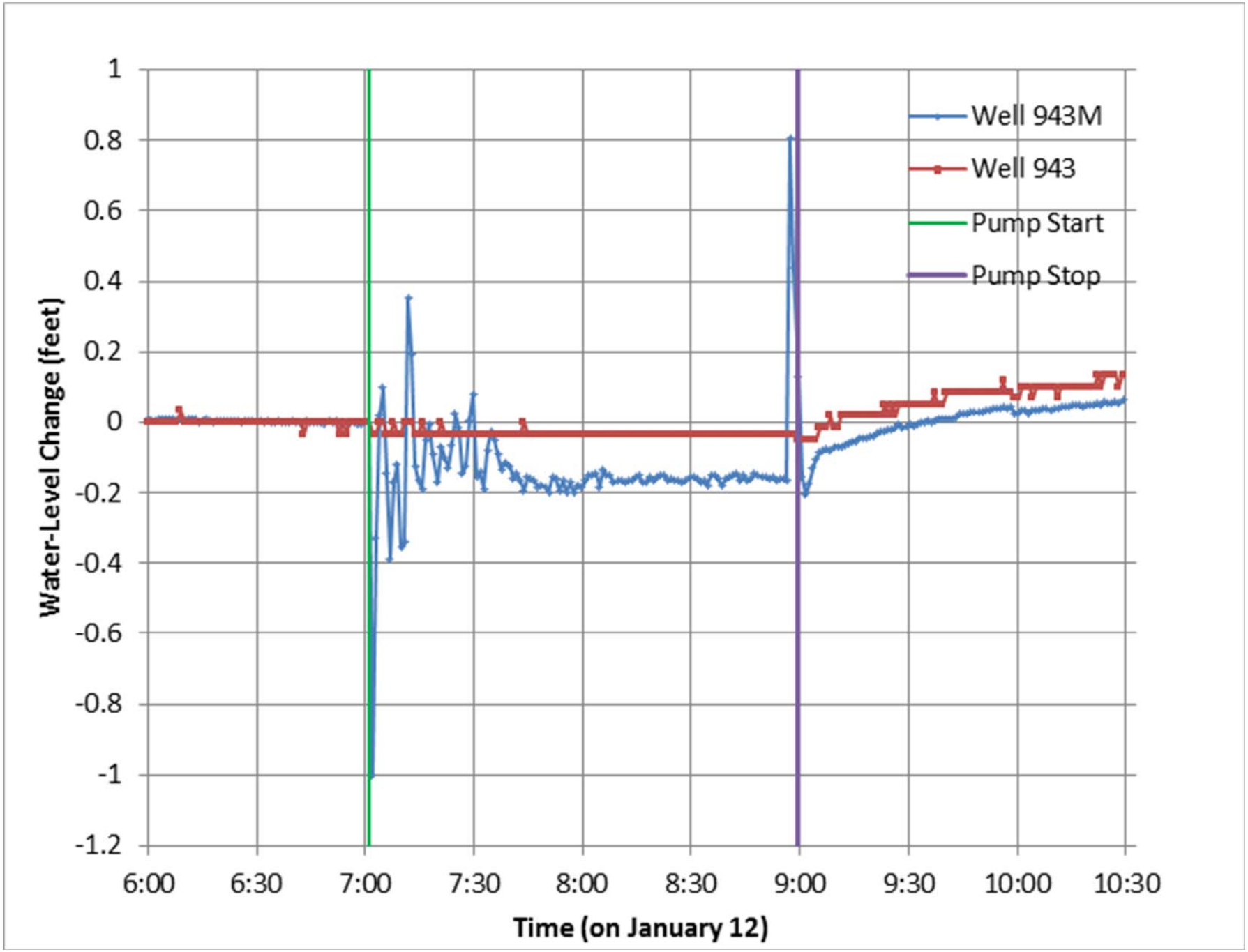
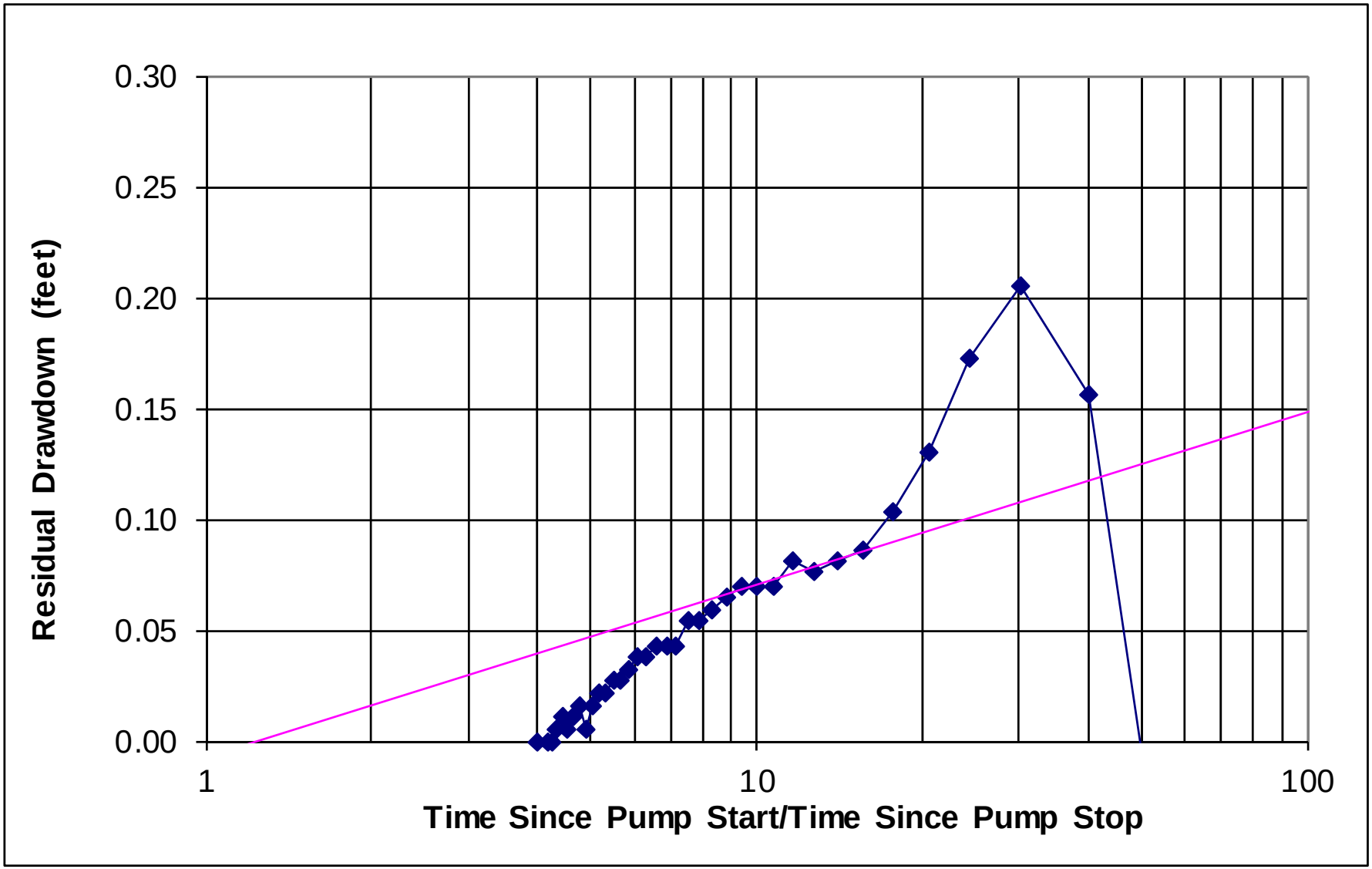


Figure 3-2. Well 943M Pump Test Water-Level Changes



Recovery Fit

Discharge (gpm)	25
Delta s (ft/log cycle time)	0.08
Transmissivity (gal/day/ft)	84958

Figure 3-3. Well 943M Recovery Analysis